1. For a whole life insurance on (75) with a death benefit of 100,000 payable at the end of the year of death, you are given:

   a. \( v^n = 30,000.00 \)
   b. \( i_0 V^n = 37,368.42 \)
   c. \( i_1 V^n = 45,498.46 \)
   d. The net benefit premium is 7500.
   e. \( i = 8\% \)

Calculate \( q_{85} \).

Solution:

\[
\begin{align*}
\text{\( i_1 V^n = \frac{(i_0 V^n + P_0)(1 + i) - (i_1)(q_{75+10})}{P_{75+10}} \)}
\end{align*}
\]

\[
45,498.46 = \frac{(37,368.42 + 7500)(1.08) - (100,000)(q_{85})}{1 - q_{85}}
\]

\[
45,498.46 - 45,498.46 \cdot q_{85} = (44,868.42)(1.08) - (100,000)(q_{85})
\]

\[
54,501.54 \cdot q_{85} = 44,868.42(1.08) - 45,498.46
\]

\[
q_{85} = \frac{44,868.42(1.08) - 45,498.46}{54,501.54} = 0.0543
\]
2. A whole life insurance on (70) provides a death benefit of 10,000 at the end of the year of death. Gross Premiums are calculated using the equivalence principle and are paid annually during the lifetime of (70).

You are given:

a. Mortality follows the Illustrative Life Table.

b. \( i = 6\% \).

c. The following expenses:
   
i. 70\% of premium in the first year.
   
ii. 10\% of premium in the second year and later.
   
iii. 150 per policy at the beginning of the first year.
   
iv. 40 per policy at the beginning of each year beginning in the second year.

Calculate the gross premium reserve at the end of the 15\textsuperscript{th} year.

Solution:

First, find the Gross Premium:

\[
P \cdot \ddot{a}_{70} = 10,000 \cdot A_{70} + 0.6P + 0.1P \cdot \ddot{a}_{70} + 110 + 40 \cdot \ddot{a}_{70}
\]

\[
P = \frac{10,000 \cdot A_{70} + 110 + 40 \cdot \ddot{a}_{70}}{(1 - 0.1)\ddot{a}_{70} - 0.6} = \frac{(10,000)(0.51495) + 110 + (40)(8.5693)}{(1 - 0.1)(8.5693) - 0.6} = 787.68
\]

Now find the reserve:

\[
15V^8 = PVFB - PVFP =
\]

\[
10,000 \cdot A_{85} + (0.1)(787.68) \cdot \ddot{a}_{85} + 40 \cdot \ddot{a}_{85} - 787.68 \cdot \ddot{a}_{85} =
\]

\[
(10,000)(0.73407) + (0.1)(787.68)(4.698) + (40)(4.698) - (787.68)(4.698) = 4,198.15
\]
STAT 490  
Fall 2012  
Quiz 6  
November 8, 2012

1. A whole life insurance on (70) provides a death benefit of 10,000 at the end of the year of death. Gross Premiums are calculated using the equivalence principle and are paid annually during the lifetime of (70).

You are given:
   a. Mortality follows the Illustrative Life Table.
   b. \( i = 6\% \).
   c. The following expenses:
      i. 80% of premium in the first year.
      ii. 10% of premium in the second year and later.
      iii. 150 per policy at the beginning of the first year.
      iv. 50 per policy at the beginning of each year beginning in the second year.

Calculate the gross premium reserve at the end of the 15\textsuperscript{th} year.

Solution:

First, find the Gross Premium:

\[
P \cdot \ddot{a}_{90} = 10,000A_{90} + 0.7P + 0.1P \cdot \ddot{a}_{90} + 100 + 50 \cdot \ddot{a}_{90}
\]

\[
P = \frac{10,000A_{90} + 100 + 50 \cdot \ddot{a}_{90}}{(1 - 0.1)\ddot{a}_{90} - 0.7} = \frac{(10,000)(0.51495) + 100 + (50)(8.5693)}{(1 - 0.1)(8.5693) - 0.7} = 809.71
\]

Now find the reserve:

\[
15V^g = PVFB-PVFP =
\]

\[
10,000A_{85} + (0.1)(809.71)\ddot{a}_{85} + 50 \cdot \ddot{a}_{85} - 809.71 \cdot \ddot{a}_{85} =
\]

\[
(10,000)(0.73407) + (0.1)(809.71)(4.698) + (50)(4.698) - (809.71)(4.698) = 4,151.98
\]
2. For a whole life insurance on (75) with a death benefit of 100,000 payable at the end of the year of death, you are given:

   a. \( v^n \) = 30,000.00
   b. \( v^{10} \) = 37,368.42
   c. \( v^{11} \) = 45,498.46
   d. The net benefit premium is 7500.
   e. \( i = 8\% \)

Calculate \( q_{85} \).

Solution:

\[
_{r+1}v^n = \frac{(v^n + P)(1 + i) - (s_{x+r})(q_{x+r})}{p_{x+r}}
\]

\[
_{11}v^n = \frac{(v^n + P_{10})(1 + i) - (s_{1})(q_{75+10})}{p_{75+10}}
\]

45,498.46 = \frac{(37,368.42 + 7500)(1.08) - (100,000)(q_{85})}{1 - q_{85}}

45,498.46 - 45,498.46 \cdot q_{85} = (44,868.42)(1.08) - (100,000)(q_{85})

54,501.54 \cdot q_{85} = 44,868.42(1.08) - 45,498.46

\[
q_{85} = \frac{44,868.42(1.08) - 45,498.46}{54,501.54} = 0.0543
\]